Quarterly Progress Report #1

Reporting Period: January 11, 2006 – March 31, 2006

Experimental Assessment of Aggregate Surfacing Materials

MDT Project No. 8117-30, MSU Project No. 4W0839

Submitted by:

Robert L. Mokwa, Ph.D., P.E.
Assistant Professor
Department of Civil Engineering
College of Engineering
Montana State University – Bozeman

Eli Cuelho, P.E.
Research Engineer
Western Transportation Institute (WTI)
College of Engineering
Montana State University – Bozeman

Submitted to:

Montana Department of Transportation
Research Programs
2701 Prospect Avenue
Helena, Montana 59620

April 2006

Task 1: Project Management/Administration

Project work was initiated on January 11, 2006 with an internal kick-off meeting at Montana State University (MSU) to review the project tasks and goals, and to discuss the types and quantities of aggregates that would be necessary to conduct the suite of proposed laboratory tests.

During this quarter, Dr. Mokwa and Mr. Cuelho oversaw the various tasks associated with the project through frequent meetings with one another and the graduate research assistant.

The start date on this project was adjusted from October 2005 to January 2006 to accommodate the funding cycle of the project graduate research assistant (Nick Trimble). The project completion date was extended to August 31, 2007, with no change in budget. Mr. Trimble will be conducting the majority of laboratory testing associated with this project, under the direct supervision of Dr. Bob Mokwa and Mr. Eli Cuelho. Mr. Trimble is a recipient of a WTI fellowship, which provides funding for his work on this project.

Task 2: Laboratory Testing

The laboratory testing program was initiated on samples of coarse aggregates obtained from multiple locations within Montana. An extensive suite of laboratory tests will be conducted on five samples of each of the following three standard aggregate types:

1. CBC Type A Grade 5 – designated in this project as CBC 5A-1 through CBC 5A-5,
2. CBC Type A Grade 6 – designated in this project as: CBC 6A-1 through CBC 6A-5, and
3. CTS Type A Grade 2 – designated in this project as CTS 2A-1 through CTS 2A-5.

Working in conjunction with personnel from the MDT Materials Department, requests were sent to MDT District offices to obtain the relatively large aggregate samples (400 to 500 lb each) that are necessary to conduct the lab tests. As detailed in Table 1, our Bozeman MSU geotechnical laboratory has received 14 of the proposed 15 samples. We greatly appreciate the assistance provided by MDT personnel in obtaining and delivering these samples.

As of March 31, 2006, we have received six CBC 6A samples, three CBC 5A samples, and five CTS 2A samples. Based on conversations that we have had with Matt Strizich, the distribution of test samples has been changed from the original plan. The updated sample distribution plan is as follows:

- 6 – CBC 6A samples
- 4 – CBC 5A samples, and
- 5 – CTS 2A samples.

In summary, we need one more sample of CBC 5A to meet the quantity distribution of the revised testing plan.

The transmittal information sheets included with some of the samples did not contain complete information regarding sample origins. These exceptions are indicated in the shaded cells of Table 1 as "not reported". We will update the table if this information can be provided by MDT.

Laboratory related activities conducted during this quarter include:

- receiving, organizing, and cataloging in-coming samples, as summarized in Table 1
- setting up and calibrating two large (10-inch-diameter) permeameters for hydraulic conductivity measurements
- setting up and calibrating the large direct shear testing machine (12-in x 12-in sample size) for the anticipated normal stresses that will be applied in this study
- commencing with laboratory testing

Table 2 summarizes the laboratory testing program and shows the quantity of tests completed as of March 31, 2006. This table will be continually updated during the study as a means of charting the progress of laboratory testing. Updated versions of the table will be provided in subsequent progress reports.

TABLE 1. Sample Descriptions

Aggregate Type	MDT District	Borrow Name or Owner	Nearest Town	County	Section Location	*Approx. Amount	Date Received	Comments
CBC 6A-1	Great Falls	John Haynes	Great Falls	Pondera	S½: S3-T28N-R7W	8 bags	2/14/06	
CBC 6A-2	Billings	Empire S&G (Wilson Pit)	Billings	Yellowstone	E½: S6-T1N-R27E	8 bags	2/14/06	
CBC 6A-3	Glendive	BLM	Miles City	Dawson	NW¼, SE¼: S9-T15N-R48E	8 bags	2/14/06	North of Terry, MT
CBC 6A-4	Missoula	Richardson, Collin	**not reported**	**not reported**	**not reported**	6 bags	2/14/06	Weeksville-West
CBC 6A-5	Butte	Neil Hazel	Toston	Broadwater	SW¼: S23-T5N-R2E	8 bags	3/15/06	US 287 So. of Toston. Project # NH8-4(41)93
CBC 6A-6	Kalispell	Sandon Const.	Kalispell	Flathead	**not reported**	8 bags	2/14/06	Commercial source
CBC 5A-1	Great Falls	Helena S&G	Helena	Lewis and Clark	SE¼, SW¼: S23-T10N-R3W	8 bags	2/14/06	
CBC 5A-2	Missoula	G. Ruffato	**not reported**	**not reported**	**not reported**	6 bags	2/14/06	North of Stevensville Wye-Florence
CBC 5A-3	Kalispell	JTL-Hodson Pit	Kalispell	Flathead	**not reported**	8 bags	3/15/06	Local commercial source
CBC 5A-4	**No sample received**							
CTS 2A-1	Havre	Peterson Pit	Devon	Toole	SW¼, NW ¼: S23-T30N-R2E	8 bags	2/14/06	
CTS 2A-2	Glendive	Fisher S&G	Glendive	Dawson	SW¼: S34-T16N-R54E	8 bags	2/14/06	
CTS 2A-3	Missoula	JTL	**not reported**	**not reported**	**not reported**	6 bags	2/14/06	
CTS 2A-4	Lewistown	Brevig Land & Live	Lewistown	Fergus	NW¼, SW¼: S21-T16N-R17E	8 bags	3/15/06	Casino Creek Concrete
CTS 2A-5	Billings	JTL	Billings	Yellowstone	SE¼, S½: S15-T1S-R25E	8 bags	3/15/06	

*Note: One bag ≅ 40 to 60 lb of material.

TABLE 2. Laboratory Testing Program Summary

Aggregate Type (No. of tests to be performed)	Gradation (1)	L. A. Abrasion (1)	Modified Proctor (1)	Direct Shear (3)	Max/Min Voids (1)	Permeability (3)
CBC 6A-1	--	--	--	--	--	--
CBC 6A-2	--	--	--	--	--	--
CBC 6A-3	--	--	--	--	--	--
CBC 6A-4	--	--	--	--	--	--
CBC 6A-5	--	--	--	--	--	--
CBC 6A-6	--	--	--	--	--	--
CBC 5A-1	--	--	--	--	--	--
CBC 5A-2	--	--	--	--	--	--
CBC 5A-3	--	--	--	--	--	--
CBC 5A-4	Sample not received		-	-	-	-
CTS 2A-1	1	1	1	--	1	--
CTS 2A-2	1	1	1	--	1	--
CTS 2A-3	1	--	--	--	1	--
CTS 2A-4	1	1	--	--	1	--
CTS 2A-5	--	--	--	--	--	--

Note: This table provides an accounting of the number of tests conducted to date. A "--" indicates the test was not conducted or has not been completed by the last day of the reporting quarter.

A literature search is underway to document similar permeability and shear strength studies that have been conducted on aggregates or base course materials.

Action Items for Next Quarter:

* Collect additional aggregate samples with MDT's assistance (one more sample of CBC 5A is needed).
* Obtain from MDT additional information regarding the origination of some of the samples (shown as "not reported" in Table 1).
* Continue laboratory testing.
* Examine and review published literature to document similar permeability and shear strength studies that have been conducted on aggregates or base course materials.

Task 3: Analyze and Synthesize Results

Data from laboratory tests are entered into spreadsheets and processed concurrently with the experimental work. Computed results are reviewed immediately for reasonableness. Synthesis of results will commence as soon as a critical mass of testing is complete.

Action Items for Next Quarter:

* Continue organizing and processing laboratory data.
* Begin synthesizing comparison test results from different aggregate samples.

Task 4: Report

Quarterly Progress Reports

Action Items for Next Quarter:

* Produce Progress Report #2 for the quarter encompassing April through June 2006

Final Report

Work on the final report will be initiated during later Quarters.

Summary of Expenditures

Table 3 summarizes the expenditures on this project through March 31, 2006. Total dollar expenditures for the project through March 31, 2006 were $4,555, leaving $38,113 for the remainder of the project.

TABLE 3. Budget Summary

Budget Category	Budgeted Funds	Spent This Period	Total Spent	Total Remaining
Salaries	$17,848.00	$204.09	$204.09	$17,643.91
Benefits	$4,628.00	$71.47	$71.47	$4,556.53
In-State Travel	$150.00	$0.00	$0.00	$150.00
Out-of-State Travel	$0.00	$0.00	$0.00	$0.00
Expendable Supplies	$200.00	$145.08	$145.08	$54.92
Tuition	$0.00	$0.00	$0.00	$0.00
Subcontracts	$0.00	$0.00	$0.00	$0.00
MDT Direct Costs	$22,826.00	$420.64	$420.64	$22,405.36
Overhead	$4,566.00	$84.13	$84.13	$4,481.87
MDT Share	$27,392.00	$504.77	$504.77	$26,887.23
WTI/MSU Share	$15,276.00	$4,050.00	$4,050.00	$11,226.00
Total	$42,668.00	$4,554.77	$4,554.77	$38,113.23

Project Schedule Summary

An updated summary of the project schedule is shown in Figure 1. The project is on schedule and on budget with anticipated forecasts.

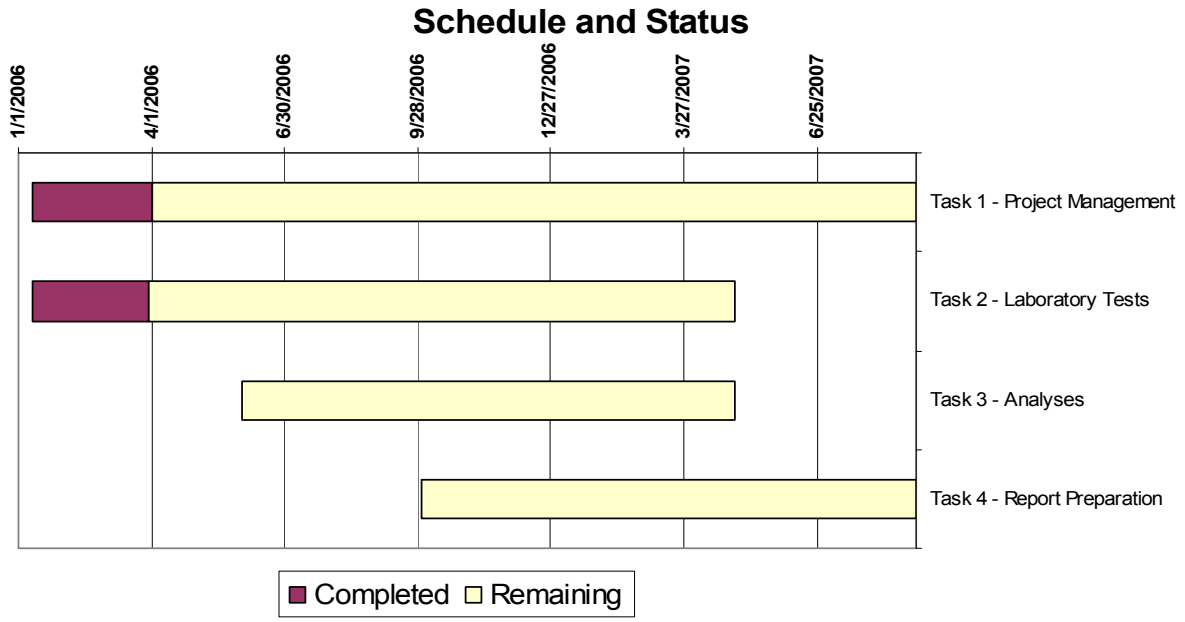

FIGURE 1. Project schedule summary.